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# McGRAW-HILL CONCISE ENCYCLOPEDIA OF SCIENCE & TECHNOLOGY

## Second Edition

**Sybil P. Parker**  
Editor in Chief

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analysis) and determine (quantitative analysis) metals and some nonmetals. Under optimum conditions, as little as  $10^{-10}$  gram of an element per gram of sample can be determined.

The steps in emission spectrochemical analysis are: vaporization and atomization of sample; excitation of atomic vapor; resolution of emitted radiation; and observation and measurement of resolved radiation. See SPECTROSCOPY. (A.T.Z.)

**Emissivity** The ratio of the radiation intensity of a non-blackbody to the radiation intensity of a blackbody. This ratio, which is usually designated by the Greek letter  $\epsilon$ , is always less than or just equal to one. The emissivity characterizes the radiation or absorption quality of nonblackbodies. Published values are readily available for most substances. Emissivities vary with temperature and also vary throughout the spectrum. For an extended discussion of blackbody radiation and related information see HEAT RADIATION. (H.G.S.; P.J.W.)

**Emitter follower** A circuit that utilizes a common-collector transistor which provides less than unity voltage gain but high input resistance and low output resistance. This circuit is used extensively to provide isolation or impedance matching between two electronic circuits.

The most common use for the emitter follower is as a device which performs the function of impedance transformation over a wide range of frequencies with voltage gain close to unity. In addition, the emitter follower increases the power level of the signal. (C.C.H.)

**Emotion** An umbrella concept in the common language, typically defined by instantiation by reference to a variety of mental and behavioral states. These range from lust to a sense of liking, from joy to hostile aggression, and from esthetic appreciation to disgust. Emotions are usually considered to be accompanied by some degree of internal, frequently visceral, excitement, as well as strong evaluative components. Emotions are also often described as irrational, that is, not subject to deliberative cogitation, and as interfering with normal thought processes.

These latter qualities are often exacerbated in the emotional behavior and expression seen in clinical cases. The expression of strong emotions is typically considered to be symptomatic of some underlying conflict, and even the positive emotions are used as indices of unusually strong attachments and atypical earlier experiences. Sigmund Freud introduced the concept of repression to describe a defense mechanism against the occurrence of strong emotional experiences. From the psychoanalytic point of view, what is repressed is not the emotion itself, since the very concept of emotion implies conscious experience, but rather the memory of an event which, if it became conscious, would lead to strong conflicts and emotional consequences. Many other defense mechanisms, such as rationalization and compulsive or obsessive neurotic symptoms, are also seen as serving the purpose of avoiding conscious conflict and emotional sequelae. See NEUROSIS; PSYCHOANALYSIS. (G.M.)

**Emphysema** A disorder of pulmonary inflation characterized by enlargement and destruction of the air spaces. The key element in this definition is the word destruction for it implies the irreversible loss of a given area of the pulmonary parenchyma. Certain variants of this condition do not necessarily imply irreparable destruction of pulmonary tissue but rather overdistention of air spaces, and consequently are not properly classified as emphysema.

Generalized emphysema probably has many causes; most share chronic bronchiolitis as a factor. Narrowing at this level would cause retention of air, leading to dilatation and rupture of alveolar septa. Increasing attention is being given to heavy cigarette smoking and air pollution as contributing factors.

Given the dilatation of the air spaces, the total air space in the lungs is increased. However, the lungs cannot be properly emptied and are functionally impaired.

Emphysema, if widespread, will cause very serious limitation in physical activity. Many cases, however, are compatible with long survival. Complications of severe emphysema include right heart failure (cor pulmonale), respiratory acidosis, and rupture of bullae with development of pneumothorax.

The important variants of emphysema are as follows. Centriobular emphysema affects predominantly respiratory bronchioles without involvement of the more peripheral elements. In diffuse vesicular emphysema, the most common form, all elements of the respiratory unit (respiratory bronchiole, alveolar ducts, alveolar sacs, and alveoli) are dilated. Senile emphysema was formerly applied to barrel-chested elderly people; however, functional impairment is, in most cases, inconspicuous. This condition is also known as aging lung. (See BRONCHIAL DISORDERS. (V.E.G.)

**Empirical method** The empirical method is generally characterized by the collection of a large amount of data before much speculation as to their significance, or without much idea of what to expect, and is to be contrasted with more theoretical methods in which the collection of empirical data is guided largely by preliminary theoretical exploration of what to expect. The empirical method is necessary in entering hitherto completely unexplored fields and becomes increasingly less purely empirical as the greater is the acquired mastery of the field. Successful use of an exclusively empirical method demands a high degree of intuitive ability in the practitioner. (P.W.Br./G.Mo.)

**Emulsion** A dispersion of one liquid in a second immiscible liquid. Since the majority of emulsions contain water as one of the phases, it is customary to classify emulsions into two types: the oil-in-water (O/W) type consisting of droplets of oil dispersed in water, and the water-in-oil (W/O) type in which the phases are reversed. The continuous liquid is referred to as the dispersion medium, and the liquid which is in the form of droplets is called the disperse phase.

A stable emulsion consisting of two pure liquids cannot be prepared; to achieve stability, a third component, an emulsifying agent, must be present. Generally, the introduction of an emulsifying agent will lower the interfacial tension of the two phases. A large number of emulsifying agents are known; they can be classified broadly into several groups. The largest group is that of the soaps, detergents, and other compounds whose basic structure is a paraffin chain terminating in a polar group. Some solid powders can act as emulsifiers by being wetted more by one phase than by the other. Whichever phase shows the greater wetting power will become the dispersion medium. Many naturally occurring emulsions, such as milk or rubber latex, are stabilized by proteins. Egg yolk proteins stabilize mayonnaise and salad dressing. Certain hydrophilic colloids such as gum arabic or gelatin also stabilize water-in-oil emulsions by a similar mode of action. See INTERPHASE OF PHASES.

Emulsions may be prepared readily by shaking together the two liquids or by adding one phase drop by drop to the other phase with some form of agitation, such as irradiation by ultrasonic waves of high intensity. In industry, emulsification is accomplished by means of emulsifying machines.

The breaking of emulsions is necessary in many industrial operations, for example, in the separation of water-in-oil emulsions in the petroleum industry and in product recovery from emulsions produced by the steam distillation of organic liquids. Emulsions may be broken by (1) addition of multivalent ions of charge opposite to the emulsion droplet, (2) chemical action (addition of acids to emulsions stabilized by soaps), (3) freeze-

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